

Analysis of the epidemiological profile of patients with traumas: A literature review

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Abstract— Trauma is a public health problem, with a high morbidity and mortality profile that generates high costs for health systems all over the world. Several factors can trigger the different types of trauma, which may require specific treatments, often even surgical procedures, and may also cause incapacity for work. In light of this, this research was intended to evaluate the epidemiological profile of patients with traumas in different regions of the world. To this end, a systematic literature review was performed by searching the Scielo database, using the descriptors "trauma" and "epidemiology", finding a total of 270 articles. Subsequently, filters were applied, which allowed 92 scientific articles to be obtained. The titles and abstracts of these articles were analyzed; and, from that, 15 articles were selected, which were read in full and then discussed. The literature analysis allowed us to characterize the epidemiological profile of traumas in Brazil and in other countries around the world, detecting that most trauma affects men at a young age, which can affect the labor system; that the low level of education can influence the trauma profile; and that factors such as car and motorcycle accidents, falls and physical aggressions are the main etiological factors of cranioencephalic, maxillofacial, thoracic, upper limbs and lower limbs traumas, among others. Thus, there is a need to formulate better preventive measures and pre- and in-hospital treatments, aiming at reducing the impact on trauma morbidity and mortality.

I. INTRODUCTION

Trauma is an injury characterized by structural changes or physiological imbalance, resulting from acute exposure to various forms of energy, including mechanical, electrical, thermal, chemical or radioactive (American College of Surgeons Committee on Trauma,

2009; Peralta and Curiel, 2019), which can trigger several types of trauma, including orthopedic, abdominal, thoracic, cranioencephalic, spinal, among others (da Silva *et al.*, 2017).

In addition, trauma is a worldwide public health problem. Its high morbidity and mortality profile implies

extremely significant problems, especially in underdeveloped and developing countries, where about 90% of deaths from trauma take place. Additionally, the costs generated are another major challenge, since studies highlight that trauma accounts for 12% of all disease expenditures (Yeung and Graham, 2010; Zanette, Waltrick and Monte, 2019).

Regarding mortality due to trauma, traffic accidents and aggressions correspond to the main external causes of death. In this sense, data from the Informatics Department of the Unified Health System (DATASUS, as per its Portuguese acronym) show that, in Brazil, only in 2017, traffic accidents and aggressions were responsible for 36,430 and 63,748 deaths, respectively (da Silva *et al.*, 2017).

The epidemiological profiles of the population most affected by trauma are young men, between 16 and 30 years of age, and with a low level of education. In the United States, automobile accidents, falls, physical aggressions and sports practice are the main causes of traumas. According to the *Revista do Colégio Brasileiro de Cirurgiões*, thoracolumbar fractures are caused, in greater proportion, by general falls. In turn, the thoracic spine is affected, in most cases, in traffic accidents (Campos and Pinto, 2012; Lentsk, Sato, Mathias, 2019).

In this context, this study is intended to evaluate the epidemiological profile of trauma victims in different regions of the world, due to the need to formulate better preventive measures and pre- and in-hospital treatments, aiming at reducing the impact on trauma morbidity and mortality.

II. MATERIAL AND METHODS

This study is a systematic literature review, with an exploratory and descriptive nature, which intends to investigate the main epidemiological characteristics related to trauma. Accordingly, a survey of the literature was conducted in an electronic database, in order to analyze articles that addressed the topic.

Thus, a search was performed in the Scielo database, using the following descriptors in English: “trauma” AND “epidemiology”. Through the Boolean operation, a total of 270 studies were found.

The following filters were applied: free and full abstract and text, collections from all countries and in all languages, publication year between 2016 and 2020, and with the type of literature focused exclusively on scientific articles, thus obtaining 92 results.

Nevertheless, after this search, the titles and abstracts of these scientific works were analyzed, and a total of 15 articles were selected because they showed themselves with greater relevance and affinity with the proposed theme (inclusion criterion), thus excluding articles that were not focused specifically on the epidemiological profile of trauma. After these filters, the 15 selected articles were analyzed in full and the data were classified by subject, being then grouped and categorized.

III. RESULTS AND DISCUSSION

Trauma is considered a worldwide public health problem, mainly due to its high profile of morbidity and mortality. According to the World Health Organization (WHO), nine people die every minute from trauma, and these ills are still responsible for an expense equivalent to 12% of total illnesses (Zanette, Waltrick and Monte, 2019; Potlaththin and Kanala, 2016).

The study of the global burden of diseases, injuries and risk factors (Global Burden of Disease – GBD), in 2017, estimated that non-fatal traumas, involving falls and traffic accidents, generated disabilities in 226.2 million people. Additionally, fatal injuries accounted for 8% of mortality worldwide, making 4.48 million victims, with an increase of 2.3% over 2007 data and a global mortality rate of 57.9 per 100,000 inhabitants (GBD, 2017).

Thus, it is important to outline the main epidemiological characteristics involving trauma in Brazil and around the world. Table 1 shows the summary of the selected articles with their respective authors, published journal and publication year (Table 1).

Table 1 – Studies that address epidemiology and trauma.

Title (in its original language)	Authors	Journal (in its original language)
<i>Análise epidemiológica de 736 pacientes que sofreram trauma facial no Brasil.</i>	Marano <i>et al.</i>	Revista Internacional de Odontostomatologia

<i>Interpersonal violence, circumstances of aggressions and patterns of maxillofacial injuries in the metropolitan area of Campina Grande, State of Paraíba, Brazil (2008-2011).</i>	Bernardino <i>et al.</i>	Ciência & Saúde Coletiva
<i>Aspectos epidemiológicos e deontológicos da mortalidade no trânsito de Roraima.</i>	Ferreira, de Souza and Flório.	Revista Bioética
<i>Trauma em Curitiba: avaliação multifatorial de vítimas admitidas em um hospital universitário.</i>	Guizzo <i>et al.</i>	Revista do Colégio Brasileiro de Cirurgias
<i>Perfil epidemiológico do trauma torácico em um hospital referência da foz do Rio Itajaí.</i>	Zanette, Waltrick and Monte.	Revista do Colégio Brasileiro de Cirurgias
<i>Fraturas de esterno em uma unidade de tratamento intensivo especializado em trauma.</i>	Pereira <i>et al.</i>	Revista do Colégio Brasileiro de Cirurgias
<i>Epidemiologia de lesões traumáticas dos membros superiores em um Hospital Universitário.</i>	Ribak <i>et al.</i>	Acta ortop.
<i>Aspectos epidemiológicos do Trauma Cranioencefálico do Hospital Municipal de Cuiabá.</i>	Vasconcelos <i>et al.</i>	Revista Internacional de Odontostomatologia
<i>Estudo epidemiológico do trauma ortopédico em um serviço público de emergência.</i>	Santos <i>et al.</i>	Cadernos Saúde Coletiva
<i>Factors related to motorcycle accidents with victims: an epidemiological survey.</i>	Greve <i>et al.</i>	Medical Express
<i>Caracterización epidemiológica y neurológica del traumatismo craneoencefálico frontal durante cinco años en Villa Clara.</i>	De Mendaro <i>et al.</i>	Centro de Mídia Eletrônica
<i>Epidemiology of spine fractures in motorcycle accident victims.</i>	De Oliveira <i>et al.</i>	Coluna
<i>Burden and profile of spinal pathology at a major tertiary hospital in the Western Cape, South Africa.</i>	Miseer, Mann and Davis	Sa Ortopédico Journal
<i>Epidemiologia de fraturas e lesões do anel pélvico.</i>	Cação <i>et al.</i>	Revista Brasileira de Ortopedia

Several studies bring facial trauma with etiology aimed at traffic accidents, falls, violence, sports injuries, and those caused in the work environment, besides the economic and socio-cultural condition of the population and the analyzed period (Shankar *et al.*, 2012).

The study by Marano *et al.* (2020) showed the main characteristics of maxillofacial fractures in a hospital in the state of Espírito Santo. In a period of 5 years, 428 patients had a facial fracture, of which 80.8% were men, who had an average age of 38.3 years. Facial fractures were divided into the group involving the middle and

upper thirds of the face (67%), another involving only the mandible (22%), and still the group that suffered from both types (11%).

Analyzing both groups, motorcycle accidents were the most common type associated with a fracture, followed by car and bicycle accidents, and also accidents in which the patient was run over. Nevertheless, when patients were separated by gender, car accidents were considered to be more prevalent among women than motorcycle accidents. Regarding fractures involving the middle and upper thirds of the face, factors such as falls (24.8%), physical aggression (19.5%), sports injuries (7.7%), gunshot wounds (4.4%) and injuries in the workplace (3.2%) were also related to the etiology of these fractures.

Conversely, Bernardino *et al.* (2017), when determining the circumstances of the aggressions and the patterns of maxillofacial traumas, observed another profile. These authors identified three groups with different victimization profiles. The first group was formed mainly by men, of different age groups, victims of community violence, resulting in fracture of facial bones or dentoalveolar fracture. In turn, the second group was composed mainly of adolescents (10-19 years old), of both genders, victims of interpersonal violence and who did not show a specific pattern of trauma. Finally, the third group, which brought together women, adults (≥ 20 years old), victims of domestic violence, resulting in injury to soft tissues of the face or in other regions of the body.

It is worth underlining that fractures that affect the maxillofacial complex are classified as very serious and are often associated with disfigurement, functional impairment, severe morbidity and high costs for health services, which may require complex therapeutic modalities for their management (Rallis *et al.*, 2015; Whitesell *et al.*, 2015).

Ferreira, Souza and Flório (2020) evaluated traffic mortality in Roraima between the years 2011 and 2015, and also detected a majority of men (85.2%), aged between 15 and 34 years (54.9%), and the main cause of death was head trauma (43.4%). It is worth underlining that Brazil ranks the 3rd place for the highest traffic mortality in the Americas and the 5th for traffic accidents in the world (PAHO, 2016).

The profile of the victims analyzed in the study by Guizzo *et al.* (2020) is similar to other surveys that show that men (70%), young people (39.4 years), victims of traffic accidents, with the motorcycle collision representing 24.3%, are the majority in traumas. Aggressions were also a relevant trauma factor in this research, and the use of alcohol was described by 57% of

patients. Regarding the severity of traumas, it was observed that the traumas considered as serious on the Glasgow Scale were more frequent at night and on weekends. It is underlined once again that the economically active population, therefore, is the most affected, thus entailing a high cost for society.

In turn, Zanette, Waltrick and Monte (2019) described the epidemiological profile of thoracic trauma (TT) in the Foz do Rio Itajaí region, located in Santa Catarina. They analyzed 119 medical charts of TT victims and found that 70.5% of victims were men, with an average age of 39.8 years. Most consultations took place during the day period (67.9%). As for admission examinations, most victims were submitted exclusively to chest X-rays (67.2%), with a prevalence of blunt thoracic trauma (89%), with motorcycle accidents as the main cause (35.2%), and the predominant injury was rib fracture (42%).

Studies with TT are important, since TT represents 10% to 15% of the total traumas in the world. In the United States, it corresponds to the 3rd most lethal type of trauma, second only to cranioencephalic trauma and extremity trauma. In Brazil, this rate corresponds to 7.3% of occurrences, being the second most frequent type of trauma, behind only extremity trauma. Moreover, TT represents approximately 25% of deaths from traumas, in addition to being a contributing factor in another 25% (Potablathin and Kanala, 2016; Silva *et al.*, 2017).

Another study that sought to evaluate the epidemiological profile of TT was conducted in an Intensive Care Unit (ICU) in São Paulo by Pereira *et al.* (2019). They observed that, in the analyzed period (January 2012 to April 2016), 57% of the patients admitted to the ICU for surgical emergencies were victims of trauma, 28.8% of whom had TT and approximately 3% had sternum fracture.

These authors also noted that sternum fractures were more present in men (84.6%), with an average age of 32 years, and the main causes of these fractures were motor vehicle accidents (46%), falls from height (32%) and people being run over (15%).

Another type of traumatic injury that is quite frequent in emergencies are upper limb injuries, which also have an impact on the patient's life and an economic burden, since these traumas often lead to incapacity for work. In light of the foregoing, Ribak *et al.* (2018) sought to evaluate the epidemiology of traumatic injuries of the upper limbs treated at a university hospital and to identify the causes, types of injuries and their risk factors.

Thus, Ribak and collaborators found that, of the 613 patients with traumas, 67.9% were men, with an

average age of 31 years, with domestic accidents being responsible for 66.6% of traumas, followed by traffic accidents (20.6 %) and occupational accidents (12.8%). In addition, it was possible to observe the existence of a correlation between the level of education and the type of accident.

Unlike the aforementioned works, Greve *et al.* (2018) evaluated the factors associated with traffic motorcycle accidents and found that fractures in the lower limbs (17%) were more common than in the upper limbs (12%). They also observed that the victims were mostly young (92%), used the motorcycle for work (23%) and 23% were unlicensed motorcyclists, 67% of whom had serious injuries. Moreover, 21% of victims were under the influence of alcohol (7%) and drugs (14%). Most accidents took place as a result of recklessness (88%), during the day (67%) and in dry weather conditions (94%).

Santos *et al.* (2016) also detected a higher prevalence of fractures in the lower limbs when analyzing 1,390 medical charts from the Emergency Hospital in Teresina. The analysis regarding the epidemiological profile showed that most victims of orthopedic trauma hospitalized were men (81%) and young people between 18 and 38 years old (61.9%). Traffic accidents were the most frequent trauma mechanisms (60.2%), and the lower limbs were the most affected, with emphasis on the knee/leg segment (23.2%). Surgery was necessary in 89.8% of trauma patients, with a greater prevalence among motorcycle accident victims (45.8%). In addition, during the studied period, Sunday was the day of the week when there was a greater number of trauma patients (18.9%).

A study conducted in Bahia that sought to analyze the incidence of spinal injuries, between 2000 and 2010, due to a motorcycle accident and its relationship with the increase in motorcycle sales in that period, was able to identify that the increase in the incidence of these injuries took place in the same period in which there was an increase in motorcycle sales in the country (de Oliveira *et al.*, 2016).

In addition, the authors observed that, between these years, there was an almost five-fold increase in the incidence of patients who suffered spinal injuries due to a motorcycle accident, with 51.4% showing cervical spine injuries, 37.2% in the thoracic spine and 11.4% in the lumbar region. Only 34.3% of patients had no neurological deficit at admission, and patients with fractures in the thoracic spine had a higher incidence and severity of spinal cord injury. The average age of these patients was 30 years.

Another study, conducted in Africa between October 2016 and September 2017, showed that traumas

related to the spine represented 75% of the analyzed cases, with automobile accidents and falls contributing 48% and 26% of traumas, respectively. Moreover, a predominance was also observed for men (67%) and that tuberculosis contributed to 87% of spinal infections, where 44% had HIV co-infection (Miseer, Mann and Davis, 2019).

In turn, Vasconcelos *et al.* (2018) sought to evaluate the main epidemiological aspects of victims of cranioencephalic trauma/traumatic brain injury (TBI) treated at the Municipal Hospital of Cuiabá. Medical charts of 669 victims were analyzed, of which 84.7% were male and had an average age of 32.8 years. In this study, the most prevalent cause of trauma was the motorcycle accident (26.6%), the neurological severity of TBI was mild in 32.5% of cases and 71.6% of patients progressed without death.

TBI involves the combination of neural and vascular injuries and their respective effects on the brain, skull and scalp (Huddleston and Ferguson, 2006). Its cause involves external physical factors that eventually result in brain injuries and lead to permanent or temporary functional or psychological damage, which may progress to death in certain circumstances (Farage *et al.*, 2002; Huddleston and Ferguson; David, 2006). In addition, TBI is a worldwide public health problem that is closely related to accidents. According to DATASUS, in 2015 alone, 37,306 victims died as a result of traffic accidents in Brazil (Ministério da Saúde, 2015).

Studies conducted in other countries also show that TBI is truly a public health problem. In the United States, for example, a TBI takes place every seven seconds, and every five minutes a person dies from it. In Cuba, accidents are the main cause of death among citizens from 15 and 49 years old, and the fourth cause in relation to other health problems (Leitgeb *et al.*, 2013; Dhandapani *et al.*, 2012; Seu *et al.*, 2014; Cicerone, 2013).

In light of this, de Mendaro *et al.* (2017) conducted a descriptive, cross-sectional and epidemiological study between January 2011 and December 2015, in order to analyze the 150 patients classified as frontal cranioencephalic traumas treated at Hospital Milián Castro, located in Cuba.

The results showed a predominance of men and an average age of 42.2 years. Traffic accidents (53.3%) were the most common cause, followed by falls (33.3%) and robberies (13.3%). Approximately one third of the surveyed patients had ingested alcoholic beverages. As for traumas, a higher incidence of minor trauma was found, with the right hemisphere, limited to the frontal lobe, taking place in most patients, being more frequently affected, with an extension to a neighboring lobe.

The epidemiological characteristics of pelvic ring fractures and injuries were the subject of study by Cação *et al.* (2017). A total of 66 patients were analyzed between August 2012 and January 2014, with an average age of 47 years, where the white race and the male gender were the most affected groups. The accident involving a car or truck was the most common cause of damage, which took place mainly in urban areas. Therefore, 16.6% of cases underwent emergency surgery, 42.4% had associated injuries and the right side of the body was the most affected side.

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REFERENCES

- [1] American College of Surgeons Committee on Trauma. Advanced Trauma Life Support - ATLS. 8 ed., 2009.
- [2] C.A. Peralta, T.S. Curiel. Manejo de complicación postarumática dental. Informe de caso. Odontologia Vital. v.30, p.7-14, 2019.
- [3] L.A. da Silva, et al.. Análise retrospectiva da prevalência e do perfil epidemiológico dos pacientes vítimas de trauma em um Hospital secundário. Rev. Med., vol. 96, p. 245-253, 2014.
- [4] J.H. Yeung, Graham CA. Guidelines for trauma quality improvement programmes. Eur J Emerg Med. v.17, 2010.
- [5] G.Z. Zanette, R.S. Waltrick, M.B. Monte. Perfil epidemiológico do trauma torácico em um Hospital Referência da Foz do Rio Itajaí. Rev Col Bras Cir, v.46, 2019.
- [6] F. Campos, G. Pinto. Manual de Iniciação em Neurocirurgia. 2. Ed. São Paulo: Livraria Santos Editora, 2012, 386 p.
- [7] M.H. Lentski, et al. Panorama epidemiológico de dezoito anos de internações por trauma em UTI no Brasil. Revista de Saúde Pública, v.53, p.83, 2019.
- [8] R.P. Potablathin, A. Kanala. Experience with chest trauma: Analysis of 400 cases. J Evid Based Med Health, v.3, p. 3986-3989, 2016.
- [9] GDB 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2018;392(10159):1789-858. X. Peng, G. Zhang, Y. Liao, D. Gong. Inhibitory kinetics and mechanism of kaempferol on α -glucosidase. Food Chemistry, v. 190, p.207-215, 2016.
- [10] R. Marano, M. Jadjiski, A.B. Matos Filho et al. Análise epidemiológica de 736 pacientes que sofreram trauma facial no Brasil. Int. J. Odontostomat, v.14, n.2, 2020.
- [11] I.M. Bernardino, K.G.N. Barbosa, L.M. Nóbrega et al. Interpersonal violence, circumstances of aggressions and pattern of maxillofacial injuries in the metropolitan area of Campina Grande, State of Paraíba Brazil (2008-2011). Ciência e Saúde Coletiva, v.22, n.9, 2017.
- [12] G. Rallis, P. Stathopoulos, D. Igoumenakis et al. Treating maxillofacial trauma for over half a century: how can we interpret the changing patterns in etiology and management? Oral Surg Oral Med Oral Pathol Oral Radiol. v.119, p.614-618, 2015.
- [13] R.T. Whitesell, S.D. Steenburg, C Shen et al. Facial fracture in the setting of whole-body CT for trauma: incidence and clinical predictors. AJR AM J Roentgenol. v.205, p. 4-10, 2015.
- [14] A.A.M. Ferreira, L.Z. de Souza, F.M. Flório. Aspectos epidemiológicos e deontológicos da mortalidade no trânsito de Roraima. Rev. Bioet, v.28, n.1, 2020.
- [15] Pan American Health Organization. Road safety in the Americas [Internet]. Washington: Paho; 2016 [acesso 15 mar 2021]. Disponível: <https://bit.ly/3aaNtmN>.
- [16] W.A. Guizzo et al. Trauma em Curitiba: avaliação multifatorial de vítimas admitidas em um hospital universitário. Ver. Col. Bras. Circ, v.47, 2020.
- [17] L.D.S. Pereira, E. Bassi, B.M. Tomazini et al. Fraturas de esterno em uma unidade de tratamento intensivo especializado em trauma. Ver. Col. Bras. Circ. V.46, n.1, 2019.
- [18] S. Ribak, E.J.N. de Oliveira, G.P. Rosolino. Epidemiologias de lesões traumáticas dos membros superiores em um Hospital Universitário. Acta Ortopédica Brasileira, v.46, n.6, 2018.
- [19] J.M.A. Greves, M.R. Resende, H.B. de Carvalho. Factors related to motorcycle accidents with victims: na epidemiological survey. Medical express. V.5, 2018.
- [20] L.F.S. Santos, J.M.A. da Fonseca, B.L.S. Cavalcante et al. Estudo epidemiológico do trauma ortopédico em um serviço público de emergência. Cad. Saúde Coletiva, v.24,n.4, 2016.
- [21] T.A.B. de Oliveira, S.M.S. Andrade, G.O. Prado et al. Epidemiology of spine fractures in motorcycle accident victims. Coluna, v.15, n.1, 2016.

- [22] S. Miseer, T. Mann, J.H. Davis. Burden and profile of spinal pathology at a major tertiary hospital in the Western Cape, South Africa. *AS Orthop.J.* v.18, n.1, 2019.
- [23] A.C. Vasconcelos, J.C. Dias, M.P.S. Wippel et al. Aspectos epidemiológicos do Trauma Cranioencefálico do Hospital Municipal de Cuiabá. *Int. J. Odontostomat.* V.12, n.1, 2018.
- [24] L. Farage, V.S. Colares, M. Cappe Neto, M.C. Moraes et al. As medidas de segurança no trânsito e a morbimortalidade intra-hospitalar por traumatismo cranioencefálico no Distrito Federal. *Rev. Assoc. Med. Bras.* v.48, p. 163-166, 2002.
- [25] S.S. Huddleston, S.G. Ferguson. *Emergências clínicas: abordagens, intervenções e autoavaliação.* Rio de Janeiro, Guanabara Koogan, 2006.
- [26] Ministério da Saúde. Departamento de Informática do SUS (DATASUS). *Informações de Saúde: Estatísticas Vitais.* Brasília, Ministério da Saúde, 2015.
- [27] J. Leitbeg, W. Mauritz, A. Brazinova et al. Glasgow coma scale na unidade de terapia intensiva prevê o resultado de um ano de pacientes com lesão cerebral traumática grave. *Eur J. Trauma Emerg Surg.*, v.39, p. 285-292, 2013.
- [28] S. Dhandapani, D. Manju, B. Sharma et al. Significado prognóstico da idade em lesão cerebral traumática. *J. Neurosci Rural Pract.* v.3, p.131-135, 2012.
- [29] S.H. Seu, F. Wang, J. Hai et al. Os efeitos do monitoramento da pressão intracraniana em pacientes com lesão cerebral traumática. *Plos One*, v.9, n.2, 2014.
- [30] K.D. Cicerone. Participação após reabilitação multidisciplinar para lesão cerebral traumática moderada a grave em adultos. *Arch Phys Med Rehabil.* v. 94, n.7, p. 1421-1423, 2013.
- [31] A.R.A.D. de Mendaro, O.C. Luna, L.D.C.A. Perez et al. Caracterización epidemiológica e neurológica del traumatismo craneoencefálico frontal durante cinco años em Villa Clara. *Medicenter Eletronico.* v.21,n.1, 2017.
- [32] G.J. Cação, E.R. Damasceno, D.I. Dinhane et al. Epidemiologia de fraturas e lesões do anel pélvico. *Rev. Bras. Ortop.* v.52, n.3, 2017.
- [33] A. Pizanis, T. Pohlemann, M. Burkhardt et al. Estabilização emergencial do anel pélvico: comparação clínica entre três técnicas diferentes. *Lesão.* V. 44, p. 1760-1764, 2013.